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DEVELOPMENT OF ASTRONOMY

A History of Astronomy. By W. W. Bryant. Pp. xiv + 355. (London: Methuen and Co., n.d.) Price 7s. 6d. net.

IT is somewhat difficult to decide on the attention to be devoted to a volume so small as the present one, as it is from the first apparent that as a "history" justice could only be done even to a few sections of the subject. The intention of the author appears to have been to give a more or less popular account of the evolution and progress of the chief divisions of the science, without attempting to render the story complete. Starting with a short review of the astronomical notions of the early races, in the first two chapters the various claims to priority of record are examined, the Chinese data purporting to extend back to 2500 B.C.; the Indian system has tables, &c., supposed to be based on phenomena of the year 3102 B.C.; Egypt and Chaldea are also of very great antiquity, the latter recording the eclipses observed at Babylon in 721 and 720 B.C. In chapters iii. and iv. the advances made by the Greeks and Arabian philosophers are briefly reviewed. The Arabs excelled in methodical accuracy, and modern astronomy owes them an immense debt for the introduction of the decimal notation, replacing the more cumbersome numerical notations of the Greeks and Romans.

The end of these two schools brings the record down to the fifteenth century, when the great revival of philosophical thought in Europe commenced to be widely felt. The work of Copernicus, who was born at Thorn, in Polish Prussia, in 1473, was published in 1543, and practically inaugurated a new era, in that the Ptolemaic system was shown to be inadmissible, and the new Copernican system soon forced its way to the front, as it explained many phenomena which previously gave difficulty. Copernicus, however, was but a theorist, and it was by Tycho Brahe, born of a noble Danish family in 1546, that the great observational advancement of the sixteenth century was made. The story is then continued, giving the successive advances made in turn by Kepler, Galileo, Newton, Laplace, and the seventeenth and eighteenth century early astronomers Flamsteed, Halley, Bradley, and Herschel. Up to this stage the treatment has been chronological, but from this point the author, apparently finding difficulty in correlating the overwhelming flood of new observations which marked the end of the eighteenth and the whole of the nineteenth century, takes a series of subject divisions, and gives the main features of progress in both theory and observation relating to each. This naturally leads to various redundancies, and we doubt if the non-expert reader will obtain a clear idea of the chronological progress during these later times.

Chapter xv. is devoted to the modern development of observatories and instruments, which is very interesting reading. No mention is made, however, of

the great influence on instrument design which has resulted from the use of the horizontal telescope in conjunction with a moving mirror of the Foucault siderostat or Lippmann coelostat type, as is done at Paris, London, and at several stations in America. Chapter xvii. deals with the discoveries connected with the physical nature of the sun, the periodicity of the sun-spots, faculae, &c. In the two following chapters the spectroscopic researches in connection with the sun are related from the time that Kirchhoff made his historic observation of absorption in 1859. Naturally the enormous development of this branch of astronomy since the 'eighties has made it impossible for the author to give more than a superficial narration of the progress made, but what he has included is both useful and interesting.

Chapters xx. to xxvi. deal with the individual members of the solar system. Most of this calls for little comment; in the chapter on Mars, predominance is given to the "carbonic acid" theory of the polar caps, but as we know from the recent researches of Lowell, it is now conclusively proved that water vapour in quantity does exist on the planet, and it is therefore unnecessary to discuss the more improbable theory. The concluding remark in this chapter is somewhat ungracious in an impartial review of the history of the subject; scepticism regarding the Lowell Observatory announcements is practically nonexistent in the minds of anyone competent to appreciate the work done at that institution. Although open-minded in general, remarks like this show a tendency to urge an isolated opinion on matters requiring very wide discussion. In general, it may be said that these chapters on the solar system are very well up to date, and a short *résumé* is added giving the more modern theories of cosmogony, in which the simplicity of the original nebular hypothesis of Laplace has gradually given way to more modified views, no one of which, however, is at present definitely accepted.

Comets, meteors, and the ZodiacaL Light are dealt with in chapter xxvii., the various cometary theories being very ably described without introducing any technicalities. Chapters xxviii.-xxxii. are occupied with the history of stellar research. The introduction and design of star catalogues of various degrees of precision, down to the great international *Carte du Ciel*, zone work, observations of proper motion and parallax, double star systems, variable stars, clusters and nebulae, &c., are described in their order of development. The penultimate chapter, on stellar spectroscopy, occupies but twelve pages, reviewing briefly the classifications of Secchi, Vogel, Pickering, Lockyer, and Huggins. A curious statement is that the star Sirius has but little atmosphere, as indicated by its thick hydrogen lines and thin metallic lines. Surely the opposite is the case; for the hydrogen absorption lines to be so wide requires a very extensive atmosphere, at the base of which there must be a very considerable gravitational pressure. Little mention is made of the enormous progress made during recent years by the investigations of "enhanced lines" in stellar classification, although this is now

accepted as a criterion for the differentiation of several of the stellar groups.

Approached with the above reservations the volume is certainly attractive, and the only serious omission appears to be the complete absence of references to sources of the information, so that a reader desirous of further study on any point is left entirely unaided.

The plates chosen for illustrating the volume are excellent and beautifully reproduced. The usefulness of many of them to the beginner will be somewhat impaired on account of the orientation letters being entirely omitted, and in several cases the plates are oriented differently from the majority, thereby leading to further confusion. Illustrations of many old portraits and ancient impressions of the solar and stellar systems are included, which will be the more interesting in that they are not easily available elsewhere. The index, well planned in general, contains many useless references, in some cases quoting names which, when referred to, prove to be merely names with no record of work done or other points of interest.

It will thus be evident that opinions on the volume will probably diverge along two lines; to the more advanced reader it is likely to appear superficial, as only touching with note-like brevity a few of the many chapters of the science; to the reader merely interested in astronomical development, however, it should appeal as a popular and very attractive account of many interesting sections of nature-study.

VON RICHTHOFEN'S CHINESE DIARIES.

Ferdinand von Richthofen's Tagebücher aus China.
Ausgewählt und herausgegeben von E. Tiessen.
Two vols., illustrated. Vol. i., pp. xv+588; vol. ii.,
pp. iv+375. (Berlin: Dietrich Reimer, 1907.)
Price 20 marks.

WHEN Ferdinand von Richthofen's life was ended his great work on China still remained unfinished. The third volume was not only unwritten, but had become unwritable, for, besides a description of southern China, it was intended to contain an account of the culture, civilisation, and organisation of China as a whole, and, apart from the magnitude of the subject, the complete alteration in the conditions of this "unchanging" country since the date of his travels had made much of his observation and experience inapplicable to the existing state of affairs. Besides the missing volume of his great work, von Richthofen also left unfinished the popular account of his travels, a work which he regarded as a duty owed to his fellow-men by every traveller in unexplored or little-known countries, and had, indeed, nearly half completed when the publication of his great work was assured, and monopolised the whole of the time and energy which was not devoted to his duties as professor. To fill in, so far as was possible, these gaps in his published work, and to meet a generally felt wish among Baron von Richthofen's old students and friends, Herr Tiessen, with rare skill, has compounded from von Richthofen's unpublished manuscripts, his diaries, and his letters home, one of the most interesting and enlightening books of travel which have been published.

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On August 3, 1868, von Richthofen left San Francisco with the deliberate intention of undertaking a geological examination of China. His hope was that if he could manage to spend a year in that country he would be able, by the importance of the results, to interest the Government and obtain from it the assistance needful for the prosecution of his purpose. This first year of work was provided for by the enlightened liberality of Californian capitalists, who foresaw the practical importance of a scientific investigation of the resources of China, and, through the Bank of California, provided funds for an expedition. Arriving in China, von Richthofen was soon disillusioned of any hope of assistance from the Government, but nevertheless, and in spite of every discouragement, determined to pursue steadfastly his resolve. After some short excursions, mostly devoted to the examination of real or reputed discoveries of coal or ores, his first important journey was the descent of the Yangtse and the examination of its banks from Hankow to its mouth. This journey was an important one in more than one way, and in none more so than in the acquisition of Paul Splingaert, a Belgian, who had acquired an intimate colloquial knowledge of the Chinese language and an insight into the character and habits of thought of the Chinese people. The value of his services appears repeatedly throughout the book, and the importance of the results of von Richthofen's travels is very largely due to the fortunate combination of the man who knew how to collect and utilise information with the man who was able to obtain it. On this journey, too, von Richthofen made the first of those observations on the loess which led to the development of his well-known and now generally accepted theory of the origin of that remarkable formation; between Nankin and Chin-kiang he found remains of *Helix* in the loess near the hill of Fangshan, and remarks that this discovery is inconsistent with the theories of Pum-pelly, who regarded the loess as a fresh-water, or of Kingsmill, who looked upon it as a marine, deposit.

The next journey took him through the province of Shantung, where he discovered large and important coalfields, and was the first to recognise the value of Kiao-chau as a port of access to, and an outlet for, the mineral wealth of the province, a discovery of which the German Government took advantage at a later period. After a long journey through Mongolia to Pekin and back to Shanghai, he accepted a proposal from the Shanghai Chamber of Commerce for an exploration of the interior of China; and so, in spite of the failure of his hopes of Government support, von Richthofen found himself in a position to carry out the design with which he left America, and on January 1, 1870, set out from Canton on the first of his two great journeys through the heart of the Chinese Empire, which ended with his return on May 21, 1872, to Shanghai; whence, after a stay of five months, devoted to preparing a report on his travels for the Shanghai Chamber of Commerce, he returned to his native land after an absence of just over twelve and a half years.

These are the travels of which we are given a simple and straightforward account devoid of all scientific technicalities. Those who wish to make use of von